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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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ART UNIT		PAPER NUMBER		
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DATE MAILED: 12/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/766,823	SATOYAMA ET AL.	
	Examiner Jae U. Yu	Art Unit 2185	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 30 January 2004.
 2a) This action is FINAL. 2b) This action is non-final.
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-20 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) Claim(s) _____ is/are allowed.
 6) Claim(s) 1-20 is/are rejected.
 7) Claim(s) _____ is/are objected to.
 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.
 10) The drawing(s) filed on 30 January 2004 is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) All b) Some * c) None of:
 1.) Certified copies of the priority documents have been received.
 2.) Certified copies of the priority documents have been received in Application No. 10/766,823.
 3.) Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)	4) <input type="checkbox"/> Interview Summary (PTO-413)
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)	Paper No(s)/Mail Date. _____
3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>1/30/04 6/22/05</u> .	5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)
	6) <input type="checkbox"/> Other: _____

The instant application having Application No. 10/766823 has a total of 20 claims pending in the application, there are 2 independent claims and 18 dependent claims, all of which are ready for examination by the examiner.

Oath/Declaration

The applicant's oath/declaration has been reviewed by the examiner and is found to conform to the requirements prescribed in 37 C.F.R. 1.63.

Status of Claim for Priority in the Application

As required by M.P.E.P. 201.14(c), acknowledgement is made of applicant's claim for priority based on an application filed in December 3, 2003.

Drawings

The applicant's drawings submitted January 30, 2004 are acceptable for examination purposes.

Information Disclosure Statement

As required by M.P.E.P. 609(c), the applicant's submission of the Information Disclosure Statement dated January 30, 2004 and June 22, 2005 are acknowledged by the examiner and the cited references have been considered in the examination of the claims now pending. As required by M.P.E.P. 609C(2), a copy of the PTOL-1449 initialed and dated by the examiner is attached to the instant office action.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: "Cluster Storage System and Replication Creation Method Thereof".

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 4, 11 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
2. Claim 11 recites the limitations "the original volume information" in lines 5-6, "the replication volume information" in lines 6-7, and "the volume pair information" in line 7. There is insufficient antecedent basis for these limitations in the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the

United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. **Claims 1, 4-6, 8, 11, 14-16 and 18** are rejected under 35 U.S.C. 102(e) as being anticipated by Kodama (US 6,728,849 B2).
2. **Claim 1** recites; “a plurality of control units each connected with a plurality of disk units”. **Figure 1** of Kodama shows the two **control units** (22 and 22’). The control units are connected with a plurality of disk units (20 and 20’, also **in column 3, at line 62**).
“A plurality of replication creation units corresponding to the plurality of the control units, each of the replication creation units being adapted to create a replication of the data of the volume in the disk unit connected with the corresponding control unit”. **Figure 1** of Kodama shows the remote copy processes (**RCP**) within the each control unit. **In column 6, at lines 54-60, Kodama recites, “It will select one and from the information provided will read the data that was earlier written from the local storage area, and in step 126 send that data with the associated identifying material to the remote storage system via the WAN.”** “A replication of the data of the volume in the disk unit” from the claim corresponds to the “associated identifying material” from Kodama.

"A plurality of volume pair information corresponding to the plurality of the control units, each of the volume pair information designating an original volume and a replicated volume". In column 2, at lines 7-10, Kodama recites, "**a pair table that identifies pairs of storage areas, one of the pair being a storage area of the local storage facility and the other being a corresponding storage area of the remote storage facility.**" "A storage area of the local storage facility" from Kodama corresponds to the "original volume" from the claim, and "storage area of the remote storage facility" from Kodama corresponds to the "replicated volume" from the claim.

"In the case where a replication is created in the volume in the disk unit connected to a first control unit, the volume information of the original volume and the volume information of the replication volume are registered in the volume pair information, and a replication is created in the volume in the disk unit connected to the first control unit based on the volume pair information." In column 8, at lines 48-54, Kodama recites, "**Review the pair table to see if the data of the received I/O write request is to be stored in a storage area corresponding to a pair that is subject to remote copying.**

If not, step 354 will be followed by step 356 in which the procedure 350 will send, to the disk controller, a data write request for each location contained in the list."

If the data is NOT subject to remote copying (i.e. "a replication is created in the volume in the disk unit connected to a first control unit" recited in the claim), the pair table contains the "volume information of the original volume and the replication volume" recited in the claim. The "volume information" corresponds to storages connected to the same controller because the data is subjected to local copying. "**If not, step 354 will**

be followed by step 356 in which the procedure 350 will send, to the disk controller, a data write request for each location contained in the list.” The data is replicated “in the volume in the disk unit connected to the first control unit” as recited in the claim because the “each location contained in the list” from Kodama is within storages connected to the same controller (not remote copying).

“In the case where a replication is created in the volume in the disk unit connected to a second control unit, the volume information of the original volume, the volume information of the replication volume and the information on the second control unit are registered in the volume pair information, and a request to create a replication is transmitted to the second control unit based on the volume pair information.” In **column 2, at lines 7-10, Kodama recites, “a pair table that identifies pairs of storage areas, one of the pair being a storage area of the local storage facility and the other being a corresponding storage area of the remote storage facility.”** The “storage area of the local storage facility” corresponds to the “original volume” from the claim, and the “storage area of the remote storage facility” corresponds to the “second control unit” from the claim. In **column3, at lines 45-53, Kodama recites, “An logical file management system is used in which logical volumes map to predetermined portions of the storage space.” “Each logical storage unit has a designated corresponding physical storage are in the storage media.”** The “logical storage unit” corresponds to the “replication volume” from the claim. In **column 6, at lines 54-60, Kodama recites, “It will select one and from the information provided will read the data that was earlier written from the local storage area, and in step 126 send**

that data with the associated identifying material to the remote storage system via the WAN." The "associated identifying material" corresponds to the "volume pair information" from the claim, and the data is "sent to the remote storage system" which corresponds to "transmitted to the second control unit" from the claim.

3. **Claim 4** recites, "the volume information of the replication volume of the first control unit registered in the volume pair information by the first control unit in the case where a replication is created in the volume of the disk unit connected to the second control unit is virtual ID information for identifying, in the first control unit, the volume of the disk unit connected to the second control unit." **In column3, at lines 45-53, Kodama recites, "An logical file management system is used in which logical volumes map to predetermined portions of the storage space." "Each logical storage unit has a designated corresponding physical storage are in the storage media."** The "virtual ID" from the claim is used to map the "logical storage unit" to the "corresponding physical storage."

"The information on the second control unit registered in the volume pair information by the first control unit in the case where a replication is created in the volume of the disk unit connected to the second control unit is ID information for identifying, in the second control unit, the second control unit and the replication volume of the disk unit connected to the second control unit." **Figure 12** from Kodama shows the "pair name" (602), "storage system" (606A) and "volume ID" (606B). The "storage system"

corresponds to the “second control unit” information from the claim. The “volume ID” corresponds to the “replication volume” information from the claim.

4. **Claim 5** recites, “The volume pair information includes an identifier assigned to the volume pair.” **Figure 12** from Kodama shows the “pair name” which corresponds to the “identifier” from the claim.

“One or a plurality of the identifiers are assigned to the one original volume.”, which means that the data is replicated in multiple remote storages. **Figure 13B** from Kodama shows storage pairs that are comprised of the multiple devices.

5. **Claim 6** recites, “The replication creation unit registers information in the volume pair information based on selected one of the information input from a user input/output apparatus and a host command received from a host.” **Figure 9A** from Kodama shows the “user input/output apparatus” which configures the remote copy pair. In **column 4, at lines 18-20, Kodama recites, “If a file-level I/O is used, the control unit will be file-intelligent so that it can respond to file-level I/O requests from a server.”** The “file-level I/O requests from a server” corresponds to the “host command” from the claim. The different I/O requests (file-level I/O or block-based I/O) cause the different volume pair information table as seen in **Figure 12 and 15.**

6. **Claim 8** recites, “a plurality of job priority set units, each of the job priority set units determining the job priority information as to whether a request for creating a

replication is to be processed equivalently to the normal read/write request, the job priority set unit notifying the job priority order information to the other control units."

Figure 1 from Kodama shows the "priority table" which corresponds to the "job priority set units" from the claim. **In column 4, at lines 52-57, Kodama recites, "The priority table, shown in greater detail in FIG. 3, contains an identification of each storage area pair and its assigned priority."** The "priority 1" from FIG. 3 corresponds to the "normal read/write request" from the claim. Since the priority is assigned to each storage area pair (primary and secondary storages), the "job priority information" is shared between other control units.

"A control unit that has received the notification of the job priority information from other control units forms a schedule for sequentially processing the requests based on the job priority information thus received." **In column 6, at lines 51-54, Kodama recites, "The send procedure will examine the RC request pending and being held in the RC queue, in step 22, to identify the request or requests having the highest priority.",** which means that the requests are processed sequentially based on the priority. The "RC queue" corresponds to the "schedule for sequentially processing the requests" from the claim.

7. **Claim 11** recites, "registering in a first control unit the original volume information and the replication volume information as the volume pair information, in the case where a replication of the data of the volume in the disk unit connected to the first control unit is created in the first control unit." **In column 8, at lines 48-54, Kodama recites,**

"Review the pair table to see if the data of the received I/O write request is to be stored in a storage area corresponding to a pair that is subject to remote copying. If not, step 354 will be followed by step 356 in which the procedure 350 will send, to the disk controller, a data write request for each location contained in the list."

If the data is NOT subject to remote copying (i.e. "a replication of the data of the volume in the disk unit connected to the first control unit is created in the first control unit), the pair table contains the "the original volume information and the replication volume information" recited in the claim. The "volume information" corresponds to storages connected to the same controller because the data is subjected to local copying.

"Registering in the first control unit the original volume information, the replication volume information in the first control unit and the information on the second control unit as the volume pair information of the first control unit, in the case where a replication of the data of the volume in the disk unit connected to the first control unit is created in the volume of the disk unit connected to the second control unit." **In column 2, at lines 7-10, Kodama recites, "a pair table that identifies pairs of storage areas, one of the pair being a storage area of the local storage facility and the other being a corresponding storage area of the remote storage facility."** The "storage area of the local storage facility" corresponds to the "original volume" from the claim, and the "storage area of the remote storage facility" corresponds to the "second control unit" from the claim. **In column3, at lines 45-53, Kodama recites, "An logical file management system is used in which logical volumes map to predetermined portions of the storage space."** "Each logical storage unit has a designated

corresponding physical storage are in the storage media.” The “logical storage unit” corresponds to the “replication volume” from the claim.

“Generating in the first control unit a replication of the volume in the disk unit connected to the first control unit, based on the volume pair information, in the case where a replication of the data of the volume in the disk unit connected to the first control unit is created in the volume in the disk unit connected to the first control unit.” **In column 8, at lines 48-54, Kodama recites, “Review the pair table to see if the data of the received I/O write request is to be stored in a storage area corresponding to a pair that is subject to remote copying. If not, step 354 will be followed by step 356 in which the procedure 350 will send, to the disk controller, a data write request for each location contained in the list.”** The data is replicated “in the first control unit” as recited in the claim because the “each location contained in the list” from Kodama is within storages connected to the same controller (not remote copying).

“Sending from the first control unit a replication creation request to the second control unit based on the volume pair information, in the case where a replication of the data of the volume in the disk unit connected to the first control unit is created in the volume of the disk unit connected to the second control unit.” **In column 6, at lines 54-60, Kodama recites, “It will select one and from the information provided will read the data that was earlier written from the local storage area, and in step 126 send that data with the associated identifying material to the remote storage system via the WAN.”** The “associated identifying material” corresponds to the “volume pair

information” from the claim, and the data is “sent to the remote storage system” which corresponds to “sending to the second control unit” from the claim.

8. **Claim 14** recites, “in the case where a replication is created in the volume of the disk unit connected to the second control unit, the volume information of the replication volume in the first control unit to be registered by the first control unit in the volume pair information is virtual ID information for identifying, in the first control unit, the volume of the disk unit connected to the second control unit.” **In column3, at lines 45-53, Kodama recites, “An logical file management system is used in which logical volumes map to predetermined portions of the storage space.” “Each logical storage unit has a designated corresponding physical storage are in the storage media.”** The “virtual ID” from the claim is used to map the “logical storage unit” to the “corresponding physical storage.”
“In the case where a replication is created in the volume of the disk unit connected to the second control unit, the information on the second control unit to be registered by the first control unit as volume pair information is the information for identifying the second control unit and the information for identifying, in the second control unit, the replication volume in the disk unit connected to the second control unit.” **Figure 12** from Kodama shows the “pair name” (602), “storage system” (606A) and “volume ID” (606B). The “storage system” corresponds to the “second control unit” information from the claim. The “volume ID” corresponds to the “replication volume” information from the claim.

9. Claim 15 recites, "The volume pair information includes an identifier assigned to the pair of the original volume and the replication volume." **Figure 12** from Kodama shows the "pair name" which corresponds to the "identifier" from the claim. The "primary volume" corresponds to the "original volume" from the claim, and the "secondary volume" corresponds to the "replication volume" from the claim. "One or a plurality of identifiers are assigned to each original volume." which means that the data is replicated in multiple remote storages. **Figure 13B** from Kodama shows storage pairs that are comprised of the multiple devices.
10. Claim 16 recites, "The first control unit registers the information in the volume pair information based on selected one of the information input from a user input/output apparatus and a host command received from the host." **Figure 9A** from Kodama shows the "user input/output apparatus" which configures the remote copy pair. In **column 4, at lines 18-20, Kodama recites, "If a file-level I/O is used, the control unit will be file-intelligent so that it can respond to file-level I/O requests from a server."** The "file-level I/O requests from a server" corresponds to the "host command" from the claim. The different I/O requests (file-level I/O or block-based I/O) cause the different volume pair information table as seen in **Figure 12 and 15.**
11. Claim 18 recites, "The job priority set unit of the first control unit sets the job priority, and notifies the job priority information to the second control unit." **In column 4,**

at lines 52-57, Kodama recites, “The priority table, shown in greater detail in FIG.

3, contains an identification of each storage area pair and its assigned priority.”

The “priority table” corresponds to the “job priority information” from the claim. Since the priority is assigned to each storage area pair (primary and secondary storages), the “job priority information” is shared between other control units.

“The second control unit forms a schedule for sequentially processing the replication creation requests based on the job priority information thus received.” **In column 6, at lines 51-54, Kodama recites, “The send procedure will examine the RC request pending and being held in the RC queue, in step 22, to identify the request or requests having the highest priority.”**, which means that the requests are processed sequentially based on the priority. The “RC queue” corresponds to the “schedule for sequentially processing the requests” from the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. **Claims 2, 3, 12 and 13** are rejected under 35 U.S.C 103(a) as being obvious over Kodama (US 6,728,849 B2) in view of Bergsten (US 6,073,209).

2. As per claim 2, Kodama discloses a “storage system” as disclosed in claim 1 (see rejection to claim 1 above).

Kodama does not disclose expressly “The replication creation unit of the first control unit copies the data of the original volume as a data for the replication volume in the cache memory of the first control unit, and transmits the copy data in the cache memory to the second control unit.”

Bergsten discloses “**The storage controller must read data from one or more MSDs into its internal memory (“the cache”) or transfer data from the cache to one or more MSDs.**” in column 10, at lines 23-26. The “storage controller” corresponds to the “replication unit” from the claim. The “MSDs” corresponds to the “original volume” from the claim, and the “internal memory” corresponds to the “cache” from the claim.

Kodama and Bergsten are analogous art because they are from the same field of endeavor of replicating data to remote storages.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add cache to Kodama, as describe by Bergsten.

The motivation for doing so would have been speeding up the replication process of Kodama because cache access is faster than mass storage access.

Therefore, it would have been obvious to combine Bergsten with Kodama for the benefit of faster replication process to obtain the invention as specified in claim 2.

As per claim 3, Kodama discloses a “storage system” as disclosed in claim 1 (see rejection to claim 1 above).

Kodama does not disclose expressly “the second control unit stores the data received from the first control unit in the cache memory of the second control unit, after which the data is stored in the volume in the disk unit connected to the second control unit.”

Bergsten discloses “**The storage controller must read data from one or more MSDs into its internal memory (“the cache”) or transfer data from the cache to one or more MSDs.**” in column 10, at lines 23-26. The “storage controller” corresponds to the “second control unit” from the claim. The first “MSDs” corresponds to the “first control unit” from the claim, and the “internal memory” corresponds to the “cache memory” from the claim. The second “MSDs” corresponds to the “volume in the disk unit connected to the second control unit” from the claim.

Kodama and Bergsten are analogous art because they are from the same field of endeavor of replicating data to remote storages.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add cache to Kodama, as described by Bergsten.

The motivation for doing so would have been speeding up the replication process of Kodama because cache access is faster than mass storage access.

Therefore, it would have been obvious to combine Bergsten with Kodama for the benefit of faster replication process to obtain the invention as specified in claim 3.

As per claim 12, Kodama discloses a “replication creation method” as disclosed in claim 11 (see rejection to claim 11 above).

Kodama does not disclose expressly “The steps of copying in the first control unit the data of the original volume to the cache memory of the first control unit, and sending from the first control unit the data stored in the cache memory to the second control unit.”

Bergsten discloses “**The storage controller must read data from one or more MSDs into its internal memory (“the cache”) or transfer data from the cache to one or more MSDs.**” in column 10, at lines 23-26. The “MSDs” corresponds to the “original volume” from the claim, and the “internal memory” corresponds to the “cache” from the claim.

Kodama and Bergsten are analogous art because they are from the same field of endeavor of replicating data to remote storages.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add cache to Kodama, as describe by Bergsten.

The motivation for doing so would have been speeding up the replication process of Kodama because cache access is faster than mass storage access.

Therefore, it would have been obvious to combine Bergsten with Kodama for the benefit of faster replication process to obtain the invention as specified in claim 12.

As per claim 13, Kodama discloses a “replication creation method” as disclosed in claim 11 (see rejection to claim 11 above).

Kodama does not disclose expressly “storing, in the second control unit, the data received from the first control unit into the cache memory of the second control unit, and

storing, in the second control unit, the data in the cache memory of the second control unit into the volume in the disk unit connected to the second control unit."

Bergsten discloses "**The storage controller must read data from one or more MSDs into its internal memory ("the cache") or transfer data from the cache to one or more MSDs.**" in column 10, at lines 23-26. The first "MSDs" corresponds to the "first control unit" from the claim, and the "internal memory" corresponds to the "cache memory" from the claim. The second "MSDs" corresponds to the "volume in the disk unit connected to the second control unit" from the claim.

Kodama and Bergsten are analogous art because they are from the same field of endeavor of replicating data to remote storages.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add cache to Kodama, as describe by Bergsten.

The motivation for doing so would have been speeding up the replication process of Kodama because cache access is faster than mass storage access.

Therefore, it would have been obvious to combine Bergsten with Kodama for the benefit of faster replication process to obtain the invention as specified in claim 13.

3. **Claims 7 and 17** are rejected under 35 U.S.C. 103(a) as being obvious over Kodama (US 6,728,849 B2) in view of Dandrea et al. (US 2002/0013864 A1).

4. As per **claim 7**, Kodama discloses a "storage system" as disclosed in claim 1 (see rejection to claim 1 above). Also, in column 4, at lines 52-57, Kodama recites,

“The priority table, shown in greater detail in FIG. 3, contains an identification of each storage area pair and its assigned priority.” The “priority 1” from FIG. 3 corresponds to the “normal read/write request” from the claim. Any priorities lower than “1” correspond to the “low job priority” from the claim. Based on the priorities, the requests are sorted in the “RC queue” in **figure 1**.

Kodama does not separate expressly the “normal read/write processing queue” and “low job priority queue” as disclosed in the claim.

Dandrea et al. discloses the two separate queues (910) in **figure 9**. In **paragraph 57, at lines 12-15, Dandrea et al. recites, “giving the new user request (NUQ) priority when doing so would not jeopardize the requirement that the steady state requests miss no access deadlines, but otherwise giving the steady state requests (SSQ) priority.”** Under normal circumstances, the “SSQ” acts as the “normal read/write processing queue”, and the “NUQ” acts as the “low job priority queue”.

Kodama and Dandrea et al. are analogous art because they are from the same field of endeavor of controlling admission for disk access requests.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to implement two separate queues to Kodama, as described by Dandrea et al.

The motivation for doing so would have been eliminating the sort process of the “RC queue” (Kodama). The contents of the “RC queue” from Kodama must be sorted based on the priorities as new data enters, and sorting causes overhead. Dandrea et

al. does not sort the contents in the queue because they are already stored in the separate queues based on their priorities.

Therefore, it would have been obvious to combine Dandrea et al. with Kodama for the benefit of reducing the overhead caused by sorting to obtain the invention as specified in claims 7.

As per claim 17, Kodama discloses a “replication creation method” as disclosed in claim 11 (see rejection to claim 11 above). Also, in column 4, at lines 52-57, Kodama recites, “The priority table, shown in greater detail in FIG. 3, contains an identification of each storage area pair and its assigned priority.” The “priority 1” from FIG. 3 corresponds to the “normal read/write request” from the claim. Any priorities lower than “1” correspond to the “low job priority” from the claim. Based on the priorities, the requests are sorted in the “RC queue” in figure 1.

Kodama does not separate expressly the “normal read/write processing queue” and “low job priority queue” as disclosed in the claim.

Dandrea et al. discloses the two separate queues (910) in figure 9. In paragraph 57, at lines 12-15, Dandrea et al. recites, “giving the new user request (NUQ) priority when doing so would not jeopardize the requirement that the steady state requests miss no access deadlines, but otherwise giving the steady state requests (SSQ) priority.” Under normal circumstances, the “SSQ” acts as the “normal read/write processing queue”, and the “NUQ” acts as the “low job priority queue”.

Kodama and Dandrea et al. are analogous art because they are from the same field of endeavor of controlling admission for disk access requests.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to implement two separate queues to Kodama, as described by Dandrea et al.

The motivation for doing so would have been eliminating the sort process of the “RC queue” (Kodama). The contents of the “RC queue” from Kodama must be sorted based on the priorities as new data enters, and sorting causes overhead. Dandrea et al. does not sort the contents in the queue because they are already stored in the separate queues based on their priorities.

Therefore, it would have been obvious to combine Dandrea et al. with Kodama for the benefit of reducing the overhead caused by sorting to obtain the invention as specified in claim 17.

5. Claims 9-10, 19-20 are rejected under 35 U.S.C 103(a) as being obvious over Kodama (US 6,728,849 B2) in view of Umberger et al. (US 2004/0059958 A1).

6. As per claim 9, Kodama discloses a “storage system” as disclosed in claim 1 (see the rejection to claim 1 above). Also, In column 6, at lines 54-60, Kodama recites, “**It will select one and from the information provided will read the data that was earlier written from the local storage area, and in step 126 send that data with the associated identifying material to the remote storage system via the**

WAN.” The “associated identifying material” corresponds to the “replication creating process” from the claim because in order to create a replication, the “identifying material” such as the pair/priority information in **figures 15 and 16** are needed. The data is “sent to the remote storage system” which corresponds to “transmitting the replication creation request” from the claim.

Kodama does not disclose expressly “a schedule for sequentially processing the requests.”, which is “RC queue” in the second control unit.

Umberger et al. discloses the “request queue” (66) in **figure 2**. The “request queue” corresponds to the “schedule for sequentially processing the requests” from the claim. The “request queue” contains the priority information (**Kodama, Figure 16**) from the first control unit, and the request is processed sequentially based on the information.

Kodama and Umberger et al. are analogous art because they are from the same field of endeavor of prioritization during replication/rebuild process.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add the “request queue” to the secondary controller unit of Kodama, as described by Umberger et al.

The suggestion for doing so would have been buffering the data coming from the “primary storage”. Since the data write to mass storage devices is slow, a faster buffer is implemented as a temporary storage.

Therefore, it would have been obvious to combine Umberger et al. with Kodama for the benefit of buffering to obtain the invention as specified in claim 9.

As per claim 10, Kodama discloses a “storage system” as disclosed in claim 1 (see rejection to claim 1 above). Also, In column 6, at lines 54-60, Kodama recites, “**It will select one and from the information provided will read the data that was earlier written from the local storage area, and in step 126 send that data with the associated identifying material to the remote storage system via the WAN.**” The “associated identifying material” corresponds to the “the priority order” from the claim because in order to create a replication, the “identifying material” such as the pair/priority information in **figures 15 and 16** are needed.

Kodama does not disclose expressly “a schedule for sequentially processing the requests.”, which is “RC queue” in the second control unit.

Umberger et al. discloses the “request queue” (66) in **figure 2**. The “request queue” corresponds to the “schedule for sequentially processing the requests” from the claim. The “request queue” contains the priority information (**Kodama, Figure 16**) from the first control unit, and the request is processed sequentially based on the information.

Kodama and Umberger et al. are analogous art because they are from the same field of endeavor of prioritization during replication/rebuild process.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add the “request queue” to the secondary controller unit of Kodama, as described by Umberger et al.

The suggestion for doing so would have been buffering the data coming from the “primary storage”. Since the data write to mass storage devices is slow, a faster buffer is implemented as a temporary storage.

Therefore, it would have been obvious to combine Umberger et al. with Kodama for the benefit of buffering to obtain the invention as specified in claim 10.

As per claim 19, Kodama discloses a “replication creation method” as disclosed in claim 11 (see rejection to claim 11 above). Also, In column 6, at lines 54-60, Kodama recites, “**It will select one and from the information provided will read the data that was earlier written from the local storage area, and in step 126 send that data with the associated identifying material to the remote storage system via the WAN.**” The “associated identifying material” corresponds to the “information indicating replication creating process” from the claim because in order to create a replication, the “identifying material” such as the pair/priority information in **figures 15 and 16** are needed. The data is “sent to the remote storage system” which corresponds to “transmitting the replication creation request” from the claim.

Kodama does not disclose expressly “a schedule for sequentially processing the requests.”, which is “RC queue” in the second control unit.

Umberger et al. discloses the “request queue” (66) in **figure 2**. The “request queue” corresponds to the “schedule for sequentially processing the requests” from the claim. The “request queue” contains the priority information (**Kodama, Figure 16**) from the first control unit, and the request is processed sequentially based on the information.

Kodama and Umberger et al. are analogous art because they are from the same field of endeavor of prioritization during replication/rebuild process.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add the “request queue” to the secondary controller unit of Kodama, as described by Umberger et al.

The suggestion for doing so would have been buffering the data coming from the “primary storage”. Since the data write to mass storage devices is slow, a faster buffer is implemented as a temporary storage.

Therefore, it would have been obvious to combine Umberger et al. with Kodama for the benefit of buffering to obtain the invention as specified in claim 19.

As per claim 20, Kodama discloses a “replication creation method” as disclosed in claim 11 (see rejection to claim 11 above). Also, In column 6, at lines 54-60, Kodama recites, “**It will select one and from the information provided will read the data that was earlier written from the local storage area, and in step 126 send that data with the associated identifying material to the remote storage system via the WAN.**” The “associated identifying material” corresponds to the “information indicating the order of priority” from the claim because in order to create a replication, the “identifying material” such as the pair/priority information in **figures 15 and 16** are needed. The data is “sent to the remote storage system” which corresponds to “transmitting the replication creation request” from the claim.

Kodama does not disclose expressly “a schedule for sequentially processing the requests.”, which is “RC queue” in the second control unit.

Umberger et al. discloses the “request queue” (66) in **figure 2**. The “request queue” corresponds to the “schedule for sequentially processing the requests” from the

claim. The “request queue” contains the priority information (**Kodama, Figure 16**) from the first control unit, and the request is processed sequentially based on the information.

Kodama and Umberger et al. are analogous art because they are from the same field of endeavor of prioritization during replication/rebuild process.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add the “request queue” to the secondary controller unit of Kodama, as described by Umberger et al.

The suggestion for doing so would have been buffering the data coming from the “primary storage”. Since the data write to mass storage devices is slow, a faster buffer is implemented as a temporary storage.

Therefore, it would have been obvious to combine Umberger et al. with Kodama for the benefit of buffering to obtain the invention as specified in claims 9-10 and 19-20.

Relevant Art Cited by the Examiner

The following prior art made of record and not relied upon is cited to establish the level of skill in the applicant’s art and those arts considered reasonably pertinent to applicant’s disclosure.

The following references teach a computer system with **virtualization/snapshot function**.

U.S. Patent Number

6,567,774 B1

Figures

2 and 6

<u>U.S. Publication Number</u>	<u>Figures</u>
2003/0204572 A1	1, 6-7

Conclusion

1. Claims Rejected in the Application

Per the instant office action, claims 1-20 have received a first action on the merits and are subject of a first action non-final.

2. Direction of Future Correspondences

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jae U. Yu whose telephone number is 571-272-1133.

The examiner can normally be reached on M-F 9AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Donald A. Sparks can be reached on 571-272-4201. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

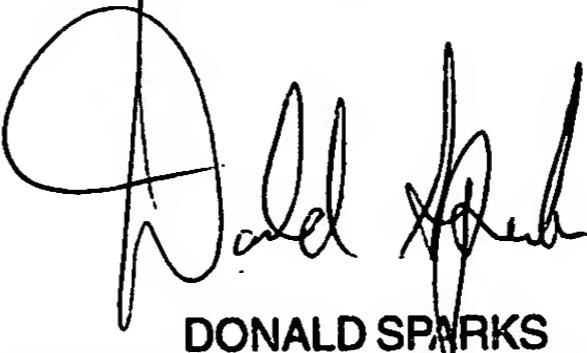
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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December 2, 2005

Jae U. Yu
Patent Examiner
Art Unit 2185



A handwritten signature in black ink, appearing to read "Donald Sparks".

DONALD SPARKS
SUPERVISORY PATENT EXAMINER